GEOGRAPHIC SCHOOL BULLETINS

THE NATIONAL GEOGRAPHIC SOCIETY, WASHINGTON 6, D. C.

VOLUME 37, NUMBER 28, MAY 4, 1959 . . . *To Know This World, Its Life*

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► Radiotelescopes Tune In the Stars
► Henry Ford's Greenfield Village
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ZUBIETA Y RETEGUI

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LT. CHARLES JOHNSON, U. S. Air Force, checks out at the gate of his base near Madrid. His week-end pass is a ticket to another world.

His big American car is clumsy on the narrow Spanish road, more suited to mule-riding peasants and donkey carts. The yellow, arid earth, barren except for a few scanty crops, contrasts sharply with the wheat-filled plains of his home in central Kansas.

Humming "the rain in Spain stays mainly in the plain," Johnson realizes suddenly that the catchy lines of the Broadway hit are poetic license. Actually, most of Spain, and especially the central plain, cannot be farmed without irrigation.

Dusty villages of one-story houses, dominated by fortresslike churches, pass by. Suddenly he sees a wall of medieval towers and battlements looming above the bleak Castilian plateau. The walls girdle Ávila, above, one of the world's finest examples of a medieval walled city. Forty feet high and 10 feet thick, the walls were built during the 12th century. The stone was taken from Roman ruins. Dark Spanish eyes no longer search the plain for invaders from these towers. Instead Johnson finds the untidy nests of storks.

The American enters the city through an elaborate gate. Women in black veils and full skirts hurry along the streets. Milk vendors goad their donkeys. Once a strategic city—it lies at the northern entrance of a pass between two mountain ranges—Ávila reached its height during the 16th century, then declined. Today the city subsists meagerly on sheep and goats.

Castile's barrenness contrasts strongly with the sunny, fertile valleys of Andalusia, where Johnson took another week-end trip. Like Ávila, the city of Jaén shows its antique origins in the ruins of a Moorish castle. But the surrounding region reveals a measure of greenness and prosperity brought by olive trees.

LUIS MARDEN, NATIONAL GEOGRAPHIC STAFF

Johnson enjoyed one of the common sights of Andalusia—men beating the branches of the silver-green olive trees with sticks, women scooping up the fallen fruit in baskets. Right, a girl of Estremadura, near Andalusia, hand-picks choice olives to avoid bruising the fruit.

Oranges, cork, grapes, wheat, barley, raisins, and vegetables are also grown in the south.

History lived for Johnson as he toured the Alhambra, fortress-palace of the Moors who ruled Spain for 800 years. Perched on a hill overlooking the Andalusian city of Granada, the Alhambra consists of a sprawling succession of rooms, porches, towers, galleries, and courtyards with fountains, Arabic inscriptions, and mosaics. Begun in 1248, the Alhambra represents western Mohammedan palace architecture at its best.

Across a ravine, Johnson saw aqueducts and conduits still

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SPANISH HOLIDAY: United States servicemen stationed at bases in Spain visit a church in Palos where Christopher Columbus attended services. Such snapshots are now displayed in many American homes, reminders of sons and husbands serving in Spain. Off duty, these men explore the culture and landscape of the host country. In 1953 Spain and the United States concluded a defense agreement by which Spain granted permission to build bases in return for American economic aid. The United States has nearly completed three bomber bases, a naval air base, an oil pipeline, radar stations, two naval depots, and other defense installations.

An American Pilot Discovers Spain

LUIS MARDEN, NATIONAL GEOGRAPHIC STAFF; TOP, U. S. NAVY

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hung with red and white lanterns. Music and dancing continue far into the night. A midway with merry-go-rounds and side shows runs down one side of the fairgrounds. Vendors hawk crayfish and white wine. A bullfight, national sport of Spain, is staged daily.

Everyone tries to look as Andalusian as possible. Johnson bought tight pants and a wide-brimmed *sevillano* hat to match those of the men who parade through the streets on horseback (below), their ladies in mantillas and full skirts riding sidesaddle behind.

While waiting for the call to "scramble" in the base's ready room, Johnson read up on the history of the places he had seen. He learned that Spain expelled the last of the foreign invaders—Moors—in 1492, the same year that a Spanish expedition discovered the New World. The empire grew rich and powerful, reaching its zenith in the 16th century. Spanish monarchs ruled the greatest Christian realm in the world, stretching from the mainland of Europe to most of South America in the Western Hemisphere and the Philippine Islands in the Far East. Spain was a world leader in art, literature, and the theater.

But the glory was not to last. Revolts, persecutions, and the loss of territorial possessions, with their wealth and manpower, weakened the country. International prestige declined. Poverty struck at home.

The Civil War (1936-1939) was the last straw. Spain emerged starving for manpower, food, and money. The victor, Generalissimo Francisco Franco, faced the task of bringing an antiquated country up to date.

LUIS MARDEN, NATIONAL GEOGRAPHIC STAFF

Spain has embarked on a program of agricultural and industrial development. American economic aid, now totaling nearly $1,000,000,000, helps.

Johnson found the Spanish character as interesting as the countryside. As a bull died, he heard pleased *oles* shouted by people who lavish tenderness on pets and who garland themselves with flowers.

He found them gay, but intensely pious—they are devout Roman Catholics.

And he discovered that Spain is a country of proud individuals. The philosopher Miguel de Unamuno wrote of the Spaniards: "It is difficult to govern a nation of 22 million kings"—and today there are more than 29 million of them. L.B.

UMI

bringing mountain spring water to underground water cisterns built by the Moors.

Traveling the countryside, Johnson found Spain a land of diversity. Language varies from province to province. Occupying six-sevenths of the Iberian Peninsula, Spain includes snow-capped mountains, bare hills, fertile green farmlands, austere steppes, and subtropical coastal plains.

Its culture is as varied as its land. Romans, Visigoths, and Moslems added their own spice to the Spanish broth, except in the Basque region of the north. Basques claim unmixed descent from ancient inhabitants of the peninsula, and they have fought fiercely to preserve their language and customs. The American found a Basque fishing village, with ancient crested doors, nearly untouched by time (below).

Johnson was lucky enough to get a pass last summer at

LUIS MARDEN, NATIONAL GEOGRAPHIC STAFF; BELOW, JUSTIN LOCKE

the time of Pamplona's famous Fiesta of San Firmín. He saw the fighting bulls let loose and teased by young Basques as they charged savagely through the plazas and narrow canyonlike streets (cover).

The Guadalquivir River and its rich, fertile basin made Andalusian Sevilla a principal seaport of Romans, Visigoths, Moors, and Spaniards. Ships steam upstream to its docks to load olives, olive oil, and cork. On a street lined with cafés (above) the pilot joined coffee drinkers who take their morning cup within sight of the world-famous Giralda, built by the Moslems as a minaret. It is now part of Sevilla's Cathedral, one of the largest Gothic churches in the world.

Sevilla's Spring Fair brings out the gaiety of the Andalusian. Johnson found the city a three-ring circus. Decorated *casetas*—temporary structures of canvas and wood—line streets

Investigators find that frogs use five kinds of sounds: mating, warning chirp, warning vibration, fright scream, and rain song. The last is a singing-in-the-shower kind of thing, apparently just for fun.

The fright scream is made with the mouth open. In some species, notably the bullfrog, it has an eerily human sound. It is uttered when the frog is in peril—caught by a hungry snake or raccoon, for example.

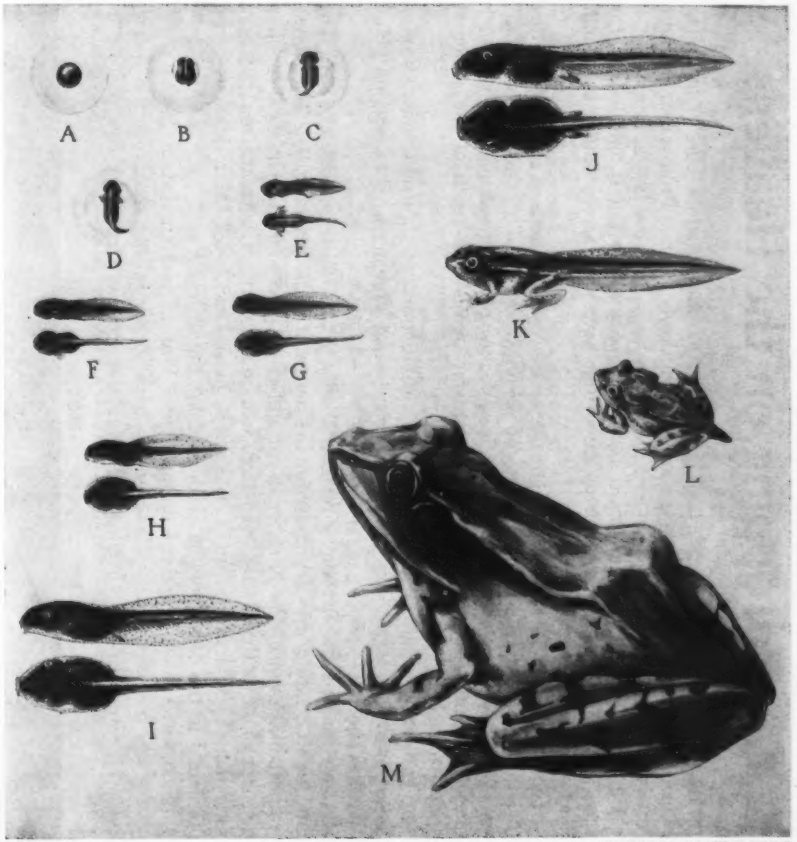
In addition to keeping the countryside awake, frog calls have been blamed for other outrages, including the inability of some Missouri hogs to put on weight. "Every time that blamed bullfrog gives out with a bellow," a farmer said ruefully, "the pigs think it's someone calling them to eat. They're running all the fat off their bones answering his call."

But frog calls can be useful to man. Scientists find it easier to determine the exact species of certain frogs by hearing them than by seeing them.

One hot summer, a Tokyo radio station drew much favorable comment with a program consisting solely of frog calls, broadcast from beside a shady country pool. Listeners reported it made them feel cool.

The director of a Virginia music festival once ordered noisy frogs evicted from around his bandstand. He relented when he found they croaked a pure C-sharp.

To all these human goings on, the frogs themselves remain oblivious. They have only one aim—to keep the world as full of frogs as possible. An egg laid as a climax to their concert develops first into a fishlike tadpole (A through I, right) which grows legs as its tail shrinks (J through L). Finally the adult, tailless and strong-legged, appears (M). F.S.



DRAWING BY HASHIME MURAYAMA

Frog Chorus Hails Spring

THE FROG CONCERT SEASON opened dramatically in Washington.

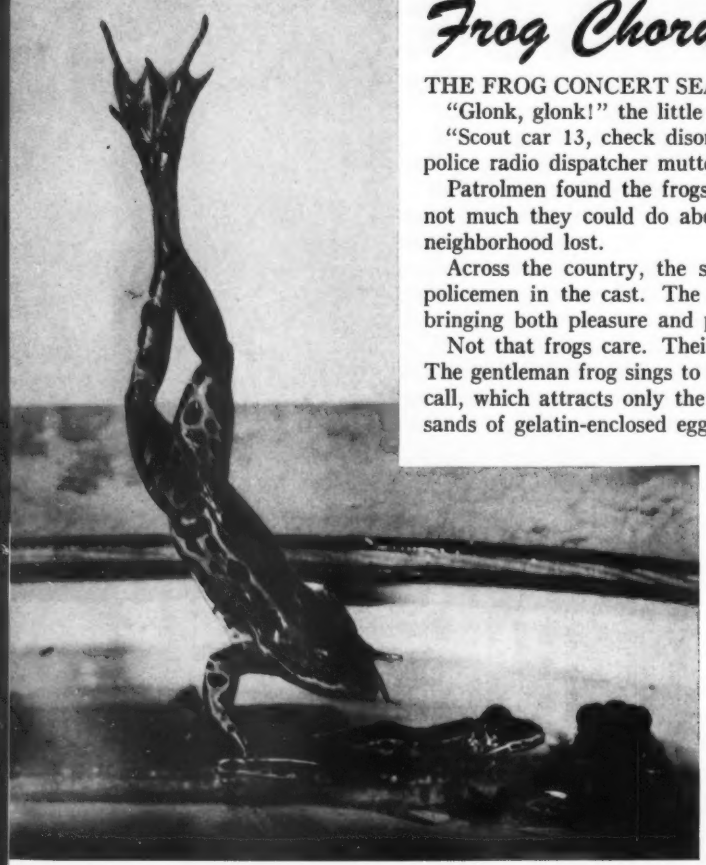
"Glonk, glonk!" the little amphibians chorused.

"Scout car 13, check disorderly frogs on Thirty-eighth Street," the police radio dispatcher muttered.

Patrolmen found the frogs making a racket, indeed. But there was not much they could do about it—regardless of how much sleep the neighborhood lost.

Across the country, the same playlet takes place, usually without policemen in the cast. The frogs puff their throats to herald spring, bringing both pleasure and pain to their human audience.

Not that frogs care. Their music is intended only for one another. The gentleman frog sings to his lady frog. Each kind has a distinctive call, which attracts only the females of the same species. Soon, thousands of gelatin-enclosed eggs will float in marsh and pond. Through a long development (see opposite page) these eggs will grow into adult frogs, admirably designed for their life on land and water. The meadow frog at left shows off his streamlining in a high dive. When he hits the water, there will be no splash—a feat a champion diver would envy. To do this, his eyes retract, "arms" move back and cling to his sides, and feet are clapped together. His nostrils will close watertight when his nose hits.



PHOTOGRAPHS BY ARTHUR A. ALLEN

GREEN TREE FROG of the southern United States swells his throat and sings bell-like notes to his mate.

The spring song of the frogs is sung with mouth closed. Air from the lungs is forced back and forth over the vocal cords to produce noises that have reminded listeners of quacking ducks, barking dogs, bleating goats, whooping Indians, or regiments of men beating tin pans.

For added volume, the frog has an air pouch under his chin (above). It acts as a resonator. In some species it swells to half the size of the entire animal.

Considerable scientific study has been devoted to frogs' calls. Dr. Arthur A. Allen, in the *National Geographic* (April 1950), has described night expeditions with microphone and recorder to collect a full vocabulary of frog talk.

PHOTOGRAPHS BY U. S. NAVY

Jodrell Bank. The U.S.S.R. says it has a 350-foot dish in operation. Australia is busy building a 200-foot device. The U. S. Navy has selected a quiet pocket in West Virginia's mountains to erect the biggest yet—over 400 feet across.

Radiotelescopes are growing ever larger for good reason. The bigger the dish, the fainter the stellar signal it can catch. Already radio astronomers have discovered some 2,000 invisible "radio sources." It has thus far been impossible to single out any individual star except the sun. But radio telescopes have made important discoveries of distant colliding galaxies, exploding stars, and clouds of cosmic gas.

Dr. Jansky's discovery also sheds light on celestial formations closer to home. In more than three centuries, optical astronomers were able to chart only a small portion of the vast spiral structure of the Milky Way. But in a short seven years, radio astronomers have traced its star-filled arms and confirmed the location of the optically obscured "Galactic Center."

Star listeners continually eavesdrop on the sun. They tune in on planets like Jupiter, Saturn, and Mars. A faint hum pinpoints the Moon.

One study of Mars produced the fact that the average temperature on that planet is slightly below the freezing point of water—an interesting nugget of knowledge for tomorrow's spacemen.

Studying voices in the sky is something like trying to pick one man's voice out of a shouting crowd. But as antennas grow in size and focussing power, radio astronomers will be able to identify many now-anonymous radio sources.

From these listening posts may come startling answers to age-old questions about the universe—even, perhaps, how it was created. A.P.M.

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Eavesdropping on the Heavens

THE SHIRT-SLEEVED SCIENTIST flicks the switch before him. Out of the corner of his eye he watches the giant antenna slowly rotate. From a near-by radio receiver tumbles a barnyard of noise: roars, grindings, crackles, hisses, rumbles.

He listens as raptly to the discord as to a symphony. For this is "music from the stars"—sounds from electromagnetic waves that have sped across thousands of millions of miles of space.

The man is a radio astronomer. His device is a radiotelescope, a new and exciting tool for probing deeply-hidden secrets of the universe. Radio astronomers "score" their heavenly music electronically with a squiggling pen on graph paper. From such lines they can "see" great clusters of stars far beyond the reach of the strongest optical telescope.

Even during bright daylight, when optical astronomers forsake their 'scopes, radio astronomers keep big dishes like this 84-foot antenna in southern Maryland aimed at the sky.

As a science, radio astronomy remains a baby. It all began one day in 1931. The late Karl G. Jansky was searching for the source of static plaguing Bell Telephone's transatlantic service. As he filtered out different types of static, he came upon a persistent hiss that came not from any earth-bound storm or from the sun, but from somewhere beyond. By scientific deduction, Jansky concluded the mysterious sound originated in the depths of the earth's galaxy, the Milky Way.

Electronic know-how gained during World War II was applied to Jansky's discovery and in recent years radiotelescopes have sprung up like mushrooms in spring. In 1957, Great Britain unveiled a 250-foot-diameter antenna in a cow pasture at

PHOTOGRAPHS BY NEAL P. DAVIS

duplicated scene, Edison quipped: "Henry, it's 99.9 percent perfect. . . We never kept the old place this clean."

To many visitors, the most fascinating building is the Henry Ford Museum. Housed in an exact duplicate of Independence Hall in Philadelphia, this superb collection of American art and industry ranges from a 600-ton locomotive to a light bulb the size of a grain of wheat.

A favorite with the throngs who visit the museum is the transportation collection. Here stand a copy of an Egyptian king's state chariot, used in 1350 B.C.; a graceful French sedan chair; a clumsy three-yoked telega from Russia; stylish phaetons, landaus, and surreys from horse-and-buggy days; formidable old locomotives; a horse-drawn streetcar.

There is a street of shops, where the work of 19th-century craftsmen is on display. Candles molded at the Susquehanna House (above) are sold at the General Store.

During a visit to a pine-paneled shop, right, two young tourists look at a century-old target rifle with William Clay Ford, one of the inventor's three grandsons. He now heads the museum and village, which has become a three-dimensional history book of America. K.C.

flap-flap of an old windmill from Cape Cod.

Mr. Ford was greatly interested in the origins of American technology. He brought to Greenfield Village many of the small workshops where tinkerers, such as he once was, developed ideas for airplanes, automobiles, engines, and electric light.

There's the Wright Brothers' bicycle shop, from Dayton, Ohio. Many of the tools the flyers used to make the first airplane lie around the shop, as though the brothers had just stepped out to lunch.

Edison's laboratory, from Menlo Park, New Jersey, is there, complete to the last shrub, tree stump, and broken bits of discarded glass. When Henry Ford proudly showed his old friend the meticulously

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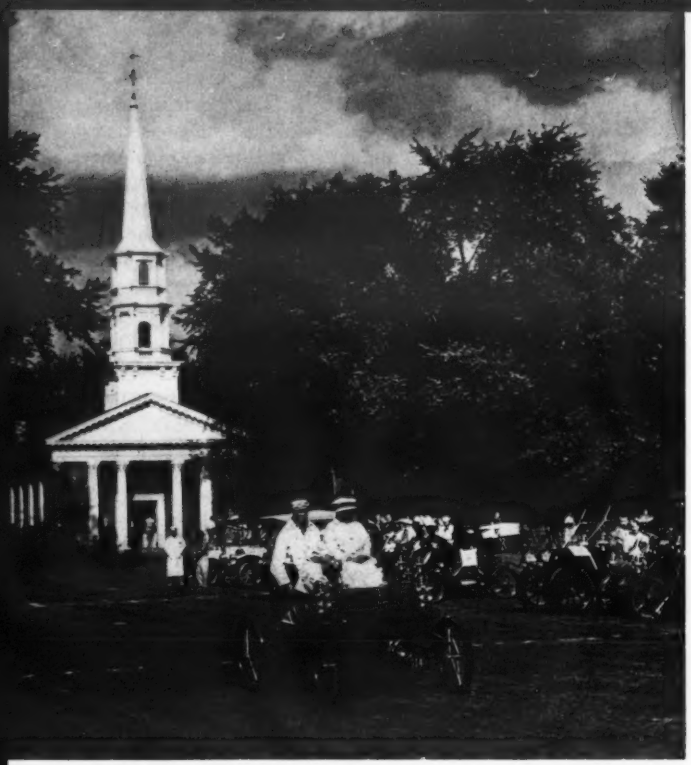

"OOGAH, OOGAH," cry the ancient horns as a 1903 Stanley Steamer drives down the green, hissing past an array of sprightly old vehicles. Her goggled and dustered owners chugged to Greenfield Village, along with about 250 other antique car enthusiasts from all over the country, for the annual Old Car Festival.

If Henry Ford, the founder of the Village, were alive today, he could show off the first Tin Lizzie of them all (below). A tinkerer's symphony of bicycle wheels, carriage cushions, old pipe, and whatever else Ford could find, it spawned America's first popular automobile.

NEAL P. DAVIS; BELOW, WILLARD R. CULVER

A Drive Into America's Past

MR. HENRY FORD collected things. Antiques, from steam engines to fine silver; ideas; machinery; tools of craftsmen; laboratories of America's great inventors; automobiles and clocks; whatever was important to the American way of life, whether great or small.

As his enormous collection poured in from all over the country and across the seas, spilling out beyond his storage space, he had to find a place where he and others could enjoy his treasures. Greenfield Village is that place.

On the outskirts of Dearborn, Michigan, not far from the throbbing River Rouge plant of the Ford Motor Company, a vast span of American history lives on across 200 acres of land. From the four corners of the United States Ford had dozens of buildings lifted bodily and transplanted to this meadow. When he couldn't move the buildings he wanted, he had exact duplicates made. His dream was to create a cross section of 19th century America, to show how people lived and worked during the momentous years of the Industrial Revolution.

The sights and sounds that greet the wandering visitor along shaded streets waft him back into another era: the clink of hammer against anvil as a horse waits to be shod; a thumping steam engine grinding fresh corn meal for the village; the soft

RALPH GRAY, NATIONAL GEOGRAPHIC STAFF

GRAND FALLS, Labrador, surpassed only by Niagara among North American cataracts, plunges 245 feet in an unpeopled wilderness 700 miles northeast of Montreal. Until recently only an occasional party (canoe in summer and dog sled in winter) reached it. Here members of a National Geographic canoe expedition stand where few had ever stood (see *National Geographic Magazine*, July, 1951).

Today a footbridge crosses the rapids above the falls and a road winds in from Mile 286 of the Quebec North Shore and Labrador Railway. Not for sightseers, these facilities are helping the British Newfoundland Corporation develop Grand Falls into Canada's largest hydroelectric plant—capable of producing four million continuous horsepower.

POWER NEEDS THREATEN GRAND FALLS

A STANDARD JOKE of waterfall guides is to express relief that the group arrived in time to see the falls before they were shut off for the season. In the case of Labrador's Grand Falls, the haunting truth is that this jest may come to pass—not for a season but for all time. The British Newfoundland Corporation plans to divert this massive cataract into a 1,000-foot vertical tunnel to generate electricity for Canada's expanding industry.

When this happens Grand Falls will fall no more (except during spring floods), the giant ledge beneath will become a damp cliff, and the plume of mist that has risen from the seething cauldron for millenniums will fade forever from wilderness air. A quiet of death will replace the earth-shaking roar as one of North America's most stupendous spectacles pours its beauty down a giant manhole. R.G.

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